Amendments to the Specification:

Please replace paragraph [0005] with the following amended paragraph:

[0005] The present railway practice requires application of black tare like sealant / rust preventative in axle fillet, axle dust guard and axle groove to protect axle against corrosion pitting. The newly designed fitted bearing backing ring that is fitted onto axle dust guards with a interference should improve the sealing of axle fillet, but still provide no protection on axle dust guards. Furthermore, large population of previously machined axles that are used with non-fitted bearing backing ring are not precisely machined in dust guard area and therefore can not benefit from the fitted bearing backing ring design.

The investigations / analysis on cracked axles as well as on other secondhand axles back from field services found that axle fillet area or axle groove area are often subject to severe localized corrosion and the sealant / rust preventative presently used cracks and degrades quickly during road service and cease to be effective as physical barrier against water/moisture ingress. The degraded / cracked sealant / rust preventative coatings actually induce severe localized corrosion in the axle fillet or the axle groove that eventually develop into major cracks under car loading.

Please replace paragraph [0010] with the following amended paragraph:

[0010] One object of the present invention is to provide methods and apparatus that will promote cathodic protection in selected critical areas of railway axle and/or selected critical areas of bearing components, preventing ~~ocalized~~ localized corrosion and resulting severe axle corrosion cracking.

Please replace paragraph [0016] with the following amended paragraph:

[0016] Figure 2 is a cross sectional view of another embodiment of the present invention in which a seal is installed over ~~an~~ railway axle dust guard.

Please replace paragraph [0018] with the following amended paragraph: (removal)

[0018]

~~Figure 4 is a cross-sectional view of another alternative to the embodiment shown in Figure 2.~~

Please replace paragraph [0022] with the following amended paragraph:

[0022]The straight end section of the axle 110 enveloped by the bearing assembly 130 is referred as axle journal 111. The section of the axle 110 where wheel 120 is mounted is referred as axle wheel seat 112. The relatively smaller diameter curved section of the axle 110 underneath the backing ring 131 is referred as axle fillet 113 and the relatively larger diameter curved section of the axle 110 located between axle fillet 113 and axle wheel seat 112 is referred as axle dust guard 114.

Please replace paragraph [0028] with the following amended paragraph:

[0028]The axle sacrificial metal reserve 160 is a plurality of sacrificial metal films deposited to following areas that remain substantially contact free during and after wheel set assembly:

(A) Portions of inner bore surfaces that remains contact free or be subject to only loose contact, including 131SI of the bearing backing ring 131, 132SI of the seal wear ring 132 and 136SI of the spacer ring 136;

(B) Portions of axle surfaces that remains contact free or be subject to only loose contact including 113S of the axle fillet 113, ~~114SI~~ 114S of the axle dust guard 114 and a portion of 111S of the axle journal 111 underneath the seal wear ring 132.

Please replace paragraph [0031] - [0035] with the following amended paragraph:

[0031] ~~The most preferred deposition process for following axle surfaces and bearing component surfaces, such as 113S, 114S, 111S, 131SI, 132SI and 136SI, is conventional self curing inorganic zinc silicate painting. Such inorganic zinc silicate coating, ranging from 1 to 10 mils thick, consists of more than 60% by volume zinc dust in finely divided particle size form dispersed in a mediums bound in a matrix of silica.~~ Since zinc or zinc alloy film is electrochemically anodic to axle and bearing steel, the ~~cured zinc paint~~zinc or zinc alloy film prevents corrosion of the underlying axle or bearing steel surfaces by providing cathodic sacrifical protection. In addition, the coating forms an impermeable barrier with zinc salts against further water or ion penetration and self heals to resume protection once the painting being damaged accidentally.

[0032] ~~Before painting, the axle surfaces are ground or machined following the present standard axle reconditioning practices. Taking advantage of relatively weak bonding strength, zinc paint can be easily removed and reapplied after completion of axle reconditioning and non-destructive inspections.~~

[0033] ~~Before painting, the surfaces of bearing components are sand or grit blasted following the present standard cleaning practices.~~

The most preferred area for zinc or zinc alloy film deposition are bearing component surfaces such as 131SI, 132SI and 136SI because

A. surface cleaning / film re-deposition can be easily achieved compared with corresponding axle surfaces such as 113S, 114S and 111S.

B. no non-destructive testing is required on those bearing component surfaces.

[0034] Under rail car loading, the axle fillet 113 and adjacent areas in the railway axle 110 are subject to locally concentrated mechanical stress due to abrupt diameter changes in the axle fillet 113. To avoid any possible stress concentration, it is a common design practice that ~~matting~~ mating bearing components, ~~in the case the~~ the bearing backing ring 131 and the seal wear ring 132, remain contact free from the axle fillet 113.

[0035] Since sacrificial metal films are deposited on those axle fillet surface 113S and ~~-~~on the bore surface ~~131S~~ 131SI and 132SI of the bearing 130 ~~backing ring 131~~ that remain substantially contact free during and after wheel set assembly, there are no risk of film damages during the bearing mounting process and dismounting process. The sacrificial metal films ~~is~~ are also protected by the mounted backing ring 131 during the long-term field services.

Please replace paragraph [0039] with the following amended paragraph:

[0039] For example, the zinc electrodeposit or magnesium strip may be applied or mounted only to inner bore surface 131SI of the bearing backing ring 131 and 132SI of the seal wear ring 132. Since

(1) the bearing backing ring 131, the seal wear ring 132 and the axle 110 are electrically connected;

(2) axle surfaces 113S, 111S, bearing surfaces 131SI and 132SI are in contact with residual lubricant / sealant 180 whose conductivity increases in case of water / mosture ingress;

(3) the axle surfaces 113S and 111S are in close proximity to 131SI, 132SI;

the zinc electrodeposit or magnesium strip applied to 131SI and 132SI act as sacrificial anode and provide not only cathodic protection to the bearing surfaces 131SI and 132SI, but also to the axle surfaces 113S and 111S.

Please replace paragraph [0042] with the following amended paragraph:

[0042] Due to the fact that all internal bearing surfaces are in contact with bearing lubrication grease 190 at the same time, and the electrical conductivity of the grease 190 increases significantly in case of water or moisture ingress, the sacrificial metal films or strips, although applied only to surface 136SO and 137SI, will act as sacrificial anodes and will provide cathodic protection to other internal surfaces of bearing components being in contact with the same bearing lubrication grease 190, for example, the surfaces of the bearing cup 137 and surfaces of the bearing cone 134.

Please replace paragraph [0048] with the following amended paragraph:

[0048] ~~Upon~~ During final stage of installation of the bearing 230 onto the axle 210, the inner flange 243 of the sleeve 240 starts to engage ~~by its inner flange 243~~ with the axle dust guard surface 214S and is forced to roll / flip inward before finally ~~rests~~ resting on the axle dust guard surface 214S ~~after rolling and flipping upwards~~. The mid section of the sleeve 240, which is longer than the axle dust guard 214, is forced to climb and roll onto the axle dust guard surface 214S, creating a bulged ~~protruded~~ double seal in the varying diameter section of the axle dust guard surface 214S. The protruded bulgy section of the sleeve 240 also protects the axle dust guard 214 against impact and protects rust preventative / sealing compound 250 that is applied on the axle dust guard surface 214S and now rests underneath the sleeve 240 against impact and UV aging.

Please replace paragraph [0050] - [0054] with the following amended paragraph:

[0050] Upon disassembly of the roller bearing 230 from the axle 210, the protective sleeve 240 can be easily removed from the axle 210 together with the bearing backing ring 231. The flexible and thin walled sleeve 240 can be deformed during the bearing dismounting process, allowing direct usage of regular tool for ~~easy~~ bearing removal.

[0051] Referring to Figure 3, an alternative embodiment of protective sleeve is provided in an identical railway wheel set arrangement as presented in Figure 2. The alternative embodiment includes an axle 310, a wheel 320, a roller bearing assembly 330, ~~a~~ rust preventative / sealant 350 and a protective sleeve 340.

[0052] Upon completion of the wheel set assembly, the protective sleeve 340 has one end 341 mounted to the backing ring 331 and the other end 342 mounted to the adjacent hub section 321 of the wheel 320.

[0053] The sleeve 340 is either pre-mounted to the backing ring 331 or pre-mounted to the wheel hub 321. The other end of the sleeve will be self-mounted upon installation of the roller bearing 330 to the axle 310. The mounted sleeve 340 may be further secured on the backing ring 331 ~~and~~ or on the wheel hub 321, either by a pair of clamp means 343 and 344 as shown in Figure 3 or by a suitable adhesive / sealant.

[0054] The mid section of the sleeve 340 is substantially longer than the length of the axle dust guard 314 thereby once bearing 330 is fully installed on axle 310, the sleeve 340 becomes bulgy ~~protruded~~, being forced into close contact with both backing ring and wheel hub, and remaining tightly sealed during long term field service. The ~~protruded~~ bulged section of the sleeve 340 also protects the axle dust guard 314 against impact, and protects rust preventative / sealant 350 that is applied on the axle dust guard surface 314S and now underneath the sleeve 340 against impact and UV aging.

Please replace paragraph [0056] with the following amended paragraph:

[0056] Upon disassembly of the wheel set, the flexible and thin walled sleeve 340 can be deformed during the bearing dismounting process, allowing direct usage of regular tool for easy bearing removal. The sleeve 340 can also be safely removed for reuse by flipping / rolling over to the backing ring 331 and dismounted from the axle 310 together with bearing assembly 310.

It is understood that other configurations of protective sleeve may also be effective, for example, a hollow O-ring that partially fitted onto the outer diameter of backing ring and extended into the axle dust guard area; or a sleeve that on one end, fitted onto the outer diameter of backing ring and on the other end, provided with surplus length so that the surplus length of the sleeve will seal the area by virtue of being squeezed in between the wheel hub face and bearing backing ring.

Please replace paragraph [0059] with the following amended paragraph:

[0059]

3. The protection schemes configured for railway axle dust guard, railway axle fillet can also be applied to other varying diameter section such as grooved areas on a shaft used in a vehicle or a shaft used in a machinery.
4. The protection schemes are illustrated and described with the help of fitted backing ring type of bearing assemblies. It is to be understood that the present invention is also applicable for use with other non-fitted backing ring type of bearing assemblies.